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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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PRODUCTION OF PARTS

Cathodes

1. Large size cathodes consisted mainly of tungsten rods, and of molybdenum supports. The cathodes usually had eight rods arranged with alternate potentials [as shown in Annex A, Fig. 1]. The individual parts were welded together; rarely were they mechanically joined. The welding was done by an oxy-hydrogen flame in a neutral atmosphere; normally nitrogen. Sometimes a mixture of 75% nitrogen and 25% hydrogen was used. Welding and heat treatment were performed in the Main Production Building on the third floor as was the production of individual parts.[1] Large size cathodes were produced mainly for CAT 10, CAT 12A, CAT 20, CAT 201, ACT 201, CAT 14C, and CAT 17C tubes.

2. Medium size cathodes had either four or two rods.

   a. The four-rod cathodes had two parallel branches arranged in a square and connected [as shown in Annex A, Fig. 2]. The four rods making the two branches were the essential part of the cathode and were of tungsten. Further, there were a support (a molybdenum rod) and a tension device (a molybdenum rod with spring attached). The tension device held the rods in a taut position. These cathodes were used for the following tubes: CAT 9, ACT 16, CAT 6, CAT 6K, ACT 14, CAM 3, CAT 3.

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b. The two-rod cathodes were similar to the four-rod cathodes and were used for the ACT 9, ACM 1S, ACM 3, ACR 2, ACS 2 tubes and for the MT types, for MR types, for DEM 2, DET 2, DET 3, and for the following high-power rectifiers: CAR 6, CAR 2, and CAR 4. The tension device for the cathodes for high-power rectifiers had a different design. The four-rod and two-rod cathodes were produced mainly in the Main Production Building on the third floor. 2.

3. Small size cathodes were the following:

a. Tungsten or thoriated tungsten cathode was an "M" shaped wire for RD 200/3.4 or a spiral shaped wire for ATL 2.

b. Nickel oxide cathode was a nickel band, "M" shaped, used for the DET 5, DET 11, CU 6, and PT 6B. These cathodes were used for mercury rectifiers in the GU 14, GU 11, GT 14, GT 15. The base was made of meshed wire, "M" or spiral shaped. The nitrogen oxide cathodes were produced in the Main Production Building. 3. They were dipped in or sprayed with barium hydroxide or barium carbonate.

4. Special cathodes consisted of copper foil tubings, and were used for Geiger Mueller tubes, GMT 16/100 and GMT 30/300. These cathodes were produced in the Main Production Building on the second floor. 4.

Grids

5. Grids consisting of molybdenum rods, four molybdenum supports, molybdenum connecting parts, and a sleeve, which was a nickel-iron sheet, /Annex A, Pt 3/ were produced on the third floor of the Main Production Building. 1. They were used for all the high-power transmitter tubes: CAT 10, CAT 12A, CAT 20, CAT 201, ACT 201, CAT 14C, CAT 17C; for medium-power modulators: ACM 1S, ACM 3, CAM 3; and for some MT special tubes.

6. Grids consisting of, usually, molybdenum supports wound with molybdenum or tungsten wire and of a sleeve (nickel-iron sheet) had circular or rectangular winding which was attached to the supports with a thin tungsten or molybdenum spiral-shaped wire /See Annex A, Fig 3a/. These grids were used for CAT 9, ACT 16, CAT 6, ACT 14, CAT 6K, CAT 3, ACT 9, ACS 2, and for some MT tubes and for DET 2 and DET 3. (These DET tubes had grids with rectangular winding.) These grids were produced on the third floor of the Main Production Building. 5.

7. Meshed grids were composed of bodies made of meshed molybdenum or tungsten wire. This meshing was in the form of a sock and was performed on an old grid machine [redacted] These grids had molybdenum supports and holders and a sleeve which was a nickel-iron sheet. 25X1

8. Wound grids consisted of from two to four supports, wound with molybdenum wire (the winding was spiral, circular, or rectangular). The supports had notches into which the winding wire was pressed. These supports were copper plus two per cent silver wire when the grid served as the first grid. They were of nickel wire when the grid served as the second or third grid. These cathodes were used for DET 5, DET 11, PT 6B. These grids were produced in the Main Production Building on the third floor. 3. They were produced on a simple grid machine (an old machine [redacted]. 25X1

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Anodes

9. Copper anodes were used for transmitter tubes with external anode. There were small, medium, and large sizes.

a. Small copper anodes were used for ACT 9, ACM 1S, ACM 3, ACR 2, ACS 2. The anode was a copper tubing with a bowl-shaped base. A copper pin with internal threads and used as a connector was soldered to the center of the base on the outside. The top of the copper tubing was turned by lathe to a knife edge to be sealed to glass later. The bowl-shaped base was achieved by a so-called metal pressing operation in which one end of the tubing revolved on the spindle of the lathe and the other end of the tubing was formed into a bowl-like shape with a dull tool. This operation was performed on the first floor of the Main Production Building.[6]

b. Medium-sized copper anodes consisted of copper tubing, the diameter of which was adjusted to the necessary size, to which a flat copper bottom was soldered in the Press Shop when the anode was used for CAT 9 and ACT 16 tubes.[7] The bottom was bowl-shaped (the same process as described above) when the anode was used for the CAT 6, ACT 14, CAT 6K, CAM 3, CAT 3 tubes. A copper pin was soldered to the center line of the bottom on the outside. In addition, a ring was soldered at the top of the tubing. This ring was shaped by being drawn up from a nickel-iron sheet by a die and a press machine. This ring had a knife edge, turned by lathe, to be sealed to the glass. There was a copper band on top of the tubing placed just below the ring to hold the tube in the water cooler. Inside the top of the tubing were notches turned by lathe /as shown in Annex B, Fig. 1/; these notches were to reflect the heat emitted from the cathode.

c. Large copper anodes for CAT 10, CAT 12, CAT 20, CAT 201, CAT 14C, CAT 17C. These anodes were copper tubing adjusted as described above (paragraph 9b). The top of this tubing was softened by gas burners and compression rings were repeatedly driven against the top to narrow it to the desired diameter. This operation was done on the third floor of the Main Production Building.[8] A flat bottom was cut from a copper plate and soldered to the tubing. A copper pin was soldered on the outside to the center of the bottom. A bronze band was soldered close to the top of the tubing and a nickel-iron ring (paragraph 9b) was soldered to the top of the tubing above the band. Notches were then turned by lathe on the top of the inside as described above. Finally, a knife edge was made on the ring by lathe. In addition, with the CAT 14C and CAT 17C types only, vertical notches were cut on the surface of the tubing in order to enlarge the surface for better cooling.

d. Anodes used for the high-power rectifiers, CAR 6, CAR 4, and CAR 2, were copper tubing shaped by a pressing operation into the form shown below:

Bronze bands were soldered to the external upper and lower part of the anode. Two nickel-iron rings were manufactured from nickel-iron sheet by lathe; one was soldered to the top and another to the bottom of the cathode. These rings had a knife edge.

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10. All copper anodes were manufactured as follows: The lathe operation was done in the Main Production Building in the Machine Tool Workshop [6] on the first floor of the Main Production Building. The following equipment was in the workshop: three lathes (two were old, one was built in Czechoslovakia after 1945), one shaper (an old Czechoslovak product), one old, imported drilling machine, one old (possibly British) lathe for metal pressing, two work benches, four vises, etc. The soldering of the anode's bottom to the nickel-iron ring was done with a silver and copper soldering rod in the Welding and Press Shop. [7] There was one gas welding apparatus and one apparatus for welding by means of an oxy-hydrogen flame. (Another gas welding apparatus was located in the Auxiliary Building. [9]) Before the glass envelope was sealed to the knife edge of the anode or to the knife edge of the grid ring, the knife edge was copper-plated. The pressing operations were done in the Welding and Press Shop by means of a hydraulic press. This was an old press of unknown origin and had one ton maximum pressure at a maximum of 20 atmospheres.

Shielding Parts

11. Anode shield rings for high-power transmitter tubes with external anode protected the seal of the anode's knife edge to the glass from the effect of the electrical field. There were always two shield rings, one inside and one outside the tube [as shown in Annex B, Fig. 2]. The external ring of the medium and largest type tubes in this category simultaneously served as a cooling device. Air was forced through drilled holes on the periphery against the seal of the knife edge to the glass. The internal shield ring was shaped from copper tubing. The external ring was pressed from a copper sheet forming a curved edge; then the shield ring was nickel-plated. Both the external and internal anode shield rings were manufactured on the first floor of the Main Production Building.

12. Various shield parts, usually made from nickel sheet, were used for shielding the cathode of medium-power special tubes (mercury rectifiers: GU 14, GU 11, GT 14, GT 15); for shielding the third grid of low-power special tubes (ie. PT 6B). All of the shield parts were produced on the third floor of the Main Production Building. [3]

Terminals

13. Terminals with nickel or copper knife edge included:

a. Heater terminals consisting of a conical-shaped part (with a flat bottom) pressed from a nickel-iron sheet. Two copper pins were welded with a silver welding rod, to the center of the bottom, one from the inside and one from the outside. Then, the knife edge was formed by lathe on the top of the conical-shaped part. [See Annex B, Fig. 3.] These heater terminals were used for high-power transmitter tubes (i.e., CAT 10, CAT 12A, CAT 20, CAT 201, CAT 14C, CAT 17C).

b. Grid terminals were also conical-shaped (pressed from copper sheet) with a copper pin inside the bottom and a knife-edge top. [See Annex B, Fig. 4.] They were used for CAT 9, ACT 16, CAT 14C, CAT 201, ACT 201. The welding and pressing was done in the Welding and Press Shop and the lathe operation in the Machine Tool Workshop. [10]

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14. Platinum terminals (so-called zdere) /Annex B, Fig. 5/ were used as heater terminals. They were of two sizes; the larger ones were used for CAT 9, and the smaller ones for CAT 3, CAM 3, CAT 6, CAT 6K, ACN 1S, ACN 3, ACR 2, ACS 2, ACT 9. These platinum terminals were supplied by Safina, National Enterprise, in Prague. To save platinum, efforts were made to replace these terminals by CrFe terminals /see Annex B, Fig. 6/. The first CrFe parts were made in the Tesla Vrsovice plant in 1952. These were samples made on the third floor of the Main Production Building. 11. The results seemed to be good but it was planned to start mass production only after the terminals had been thoroughly tested on tubes in operation.

15. Straight platinum terminals consisted of a nickel part which was inside the tube, a platinum center part which was sealed into the lead glass, and an external part which was a copper cable (copper filaments woven together). /See Annex C, Figs 1 and 1a./ These platinum terminals were used as general terminals for MT tubes (except the MT15), MR tubes, and for the DEM 2, DET 2, DET 3 tubes. They were also used as grid terminals for the following high-power transmitter tubes: CAM 3, CAT 3, CAT 6, ACT 14, CAT 10, CAT 12A, CAT 20. The straight platinum terminals were produced in the Main Production Building on the third floor. 11. Since 1952, efforts had been made to replace these platinum terminals for the MR and MT type tubes in order to conserve platinum. As a substitute, nickel-iron-copper wire was sometimes used.

16. Molybdenum terminals were rods from one to four millimeters in diameter and were sealed into molybdenum glass. The current was conducted to the terminal by a copper cable which entered a nickel tubing, welded electrically to the terminal. Usually the copper cable was welded to the terminal before the tube was finished. This procedure, however, caused the oxidation of the cable during further production processes of the tube and the oxidized cable broke easily. For this reason, rejects of the RD 200/3.5 tubes jumped from 10% to 25% in 1951. Therefore, with respect to this tube, the copper cable was welded to the terminal after the whole tube was finished. Molybdenum terminals were used for GU 11, GU 14, GT 14, GT 15, MT 14, and RD 200/3.5 tubes. They were manually produced on the third floor of the Main Production Building. 11.

Input Leads

17. Input leads from nickel-iron-copper wire were made as follows: the internal part of the lead was nickel and the center part, which was sealed into the lead glass, was nickel-iron-copper wire of 0.35 mm., 0.4 mm., or 0.5 mm., and sometimes up to 0.8 mm. in diameter. The length of the center part was about five millimeters. The external part was a copper cable or copper wire. All three parts were welded together /Annex C, Fig. 2/. These input leads were mainly used for low-power special tubes, i. e., DET 5, DET 11, CU 6, PT 6B, RHT 1, RHT 2, and for the Geiger-Mueller tubes. Nickel-copper wire was used as a grid lead for the ACT 9, ACM 1S, ACM 3, ACS 2 tubes. The grid leads were produced on the third floor of the Main Production Building. 12.

Cooling Rings

18. Cooling rings were copper tubings welded into a circle with drilled holes on the outside. They were used for high-power transmitter tubes with external anode. The cooling ring was fastened to the band of the tube by copper strips, and air was forced through the openings in order to cool the seal of the glass to the anode. Air was conducted into the cooling ring by a rubber hose. Cooling rings were produced manually on the third floor of the Main Production Building. 13. The surface of the ring was nickel plated in the Auxiliary Production Building (Annex). 14.

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Grid Rings for CAT 17C

19. Grid rings for the CAT 17C tubes were made as follows. A pressing operation produced a cup-shaped object from a nickel-iron sheet. The bottom of the cup was cut out and a copper band was soldered to the outside of the remaining nickel-iron ring by means of a silver welding rod. The copper band was centered on this nickel-iron ring. A knife edge to be sealed to glass was made on both edges of the ring by lathe. The pressing took place in the Welding and Press Shop, 7. the lathe operation in the Machine Tool Workshop. 6.

Heater Leads

20. Heater leads (for cathode heating) were of two types:

a. Non-cooled leads, used for high-power electronic tubes with external anode. These leads consisted of a copper rod (external), copper cable (center), and copper rod (internal) which was threaded at the ends for screwing to the heater terminals. The parts were welded together with a silver welding rod. /Annex C, Fig. 3/.

b. Forced air-cooled leads, for the largest high-power transmitter tubes: CAT 17C, CAT 14C, CAT 201. The external part was a copper tube through which cool air was driven. A bronze tubing was welded to the copper tube with a silver welding rod. The bronze tube was shaped like an accordion to counterbalance the expansion of the lead caused by heat. The internal part was a copper tube with openings in the surface, serving as outlets for the cool air. This tube was threaded for screwing into the heater terminal. /Annex C, Fig. 4/. The lathe work for the production of heater leads took place in the Tool Shop of the Production Building; 15. the welding and assembly in the Auxiliary Production Building. 7. The bronze tubing was delivered from another plant but Source did not know which one.

Supports and Bases

21. Supports and bases of various designs and sizes usually made of copper or brass strips, were used to support heater terminals of the cathode for all high-power transmitter tubes with external anode. In addition such parts were used to support heater leads, anode outlets and grid outlets of the following tubes: MT, MR, DEM 2, DET 2, and DET 3. These were made from brass (usually brass strips) and insulating plate. Also included in this category were various other supporting parts such as copper strips which were placed around the grid ring of the CAT 17C and used as an external terminal for the grid, grid terminals (copper strips) for the CAT 9 and ACT 16 high frequency transmitting tubes, and also grid terminals for the non-high frequency transmitting tubes.

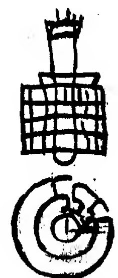
22. Standard supports (which served to support heater leads as well as grid terminals) for ACT 9, ACM 1S, ACM 3, ACR 2 and ACS 2 consisted of brass tubing, and a ceramic insulating plate with brass contactors. Standard bases for mercury rectifiers for GU 11, GT 14 and GT 15 consisted of a sleeve of nickel sheeting, an insulating plate (pertinax or hardened Bakelite cardboard) and brass contactors which were set in the insulating plate. Standard bases for RD 200/3.5 and for PT 6B consisted of a sleeve of nickel or aluminum sheeting, a ceramic insulating plate, and brass contactors.

23. The production and assembly of supports and bases took place in the Main Production Building on the third floor. 16. The brass contactors were produced in the tool shop of the Production Building. 15. The ceramic insulating plates were supplied from another Czechoslovak plant (Source did not know which one). Other insulating parts were produced in the Main Production Building on the third floor. 16. In addition, there was also assembly of supports in the Main Production Building second floor. 17. All the metal supports not made of nickel were nickel-plated, with the exception of aluminum parts.

Coolers

24. Coolers were of two types: Coolers with horizontal cooling fins for air-cooled high-power transmitter tubes with external anode - for ACT 16, ACT 201 and ACT 14; 18. coolers with axial cooling fins for the smallest air-cooled high-power transmitter tubes with an external anode, i. e., for ACT 9, ACM 1S, ACR 2, ACS 2.

The cooling fins were copper strips about four centimeters wide and formed as illustrated:



They were assembled in rows around the anode to form a cylinder. The cooler was attached to the anode by screwed sleeves. The coolers were produced in the Main Production Building on the second floor. 17.

Glass Parts

25. The equipment for producing glass parts was located in the Main Production Building on the third floor. 19. The main equipment consisted of:

a. A large sealing lathe adjustable for horizontal or vertical operation. This was an old lathe, probably imported from England before World War II. It was used to seal the anode glass envelope to the glass stem of the cathode, as well as to seal the glass envelope to the knife edge of the anode or to the knife edges of the grid rings of the CAT 17 tube. This sealing lathe was used for high-power transmitter tubes with external anode: CAT 14C, CAT 17C, CAT 201, ACT 20, CAT 12A, CAT 20 and CAT 10.

b. Two medium-size glass sealing lathes. These were old lathes, [redacted] They were used primarily for sealing operations which were necessary for the manufacture of high-power transmitter tubes (with external anode) of a smaller size than mentioned above (paragraph 25 a): CAT 9, ACT 16, CAR 6, CAR 4, CAR 2, CAT 6, ACT 14, CAT 6K, CAM 3 and CAT 3; but also for most of the sealing operations connected with the production of large stems. 25X1

 [redacted] 25X1

c. Three sealing machines; one was used for medium-power transmitter tubes (ACT 9, ACM 1S, ACM 3, ACR 2 and ACS 2); another for the MR-type tubes and the DEM 2, DET 2, DET 3; and the third for GU 11, GU 14, GT 14 and GT 15. These machines [redacted] 25X1 were vertical sealing machines which could simultaneously handle four tubes, each at a different stage. The first three stages were to heat the glass gradually; the actual sealing was performed in the fourth stage. There was one pair of gas burners for every stage; burners were placed opposite each other and handled manually. The platform on which the tubes were placed was manually revolved from one stage to the next.

d. A sealing machine for low-power tubes: RD 200/3.5, DET 5, DET 11, PT 6B, RHT 1 and RHT 2. This machine was similar to the machines mentioned above (paragraph 25 c); [redacted] 25X1

e. A machine for the production of small stems for RD 200/3.5, DET 5, DET 11, CU 6, PT 6B, RHT 1, RHT 2, GU 14, GU 11, GT 14 and for the GM tubes. This was a vertical machine with four to six stages [redacted] 25X1 arranged in a circle. There was one pair of gas burners (burners were placed opposite each other) for every stage. Gas and air were used as fuel for the burners when soft glass stems were being processed, and in addition, oxygen was introduced when hard glass stems were processed. Four, or perhaps six, stems could be produced simultaneously. The parts of the stem were assembled and then heated gradually until they were sealed together in the last stage and the stem was pressed into the desired form. The burners were handled manually. This machine was also imported from England prior to World War II.

f. Electric tempering furnaces for cooling glass parts (mainly stems) in order to remove the internal tension of the glass created in processing. The glass parts were put into the furnace, heated slightly above the transformation point, left at this temperature for a certain period, and then the furnace was switched off and the parts were left inside until cool. The inside of the furnace was made of fireproof clay and electrically heated by heating spirals. The desired temperature was maintained by a thermostat. There were three tempering furnaces in the plant -- an older one, of 15 kw., of unknown origin, and two newer ones of 5 kw. each, possibly of Czechoslovak origin.

g. Tempering equipment, vertically revolving, with four stages. After the sealing was completed, the tube was put into the tempering equipment where it passed through the four stages, the gas flame of each stage having a lower temperature. There were four units of this equipment, but only three were in operation. Some of these units were of foreign origin; the others were manufactured in the Tesla Vrsovice plant.

h. Two devices for cutting glass envelopes and tubes, operated manually. Both were manufactured in the plant. A heating resistance wire, one end of which was connected to one pole of a transformer (one transformer was six volt, the other twelve), was wound around the glass; the other end of the wire was connected to the other pole of the transformer. The wire was heated, thus quickly heating the glass which caused it to snap where the wire was placed.

i. Work benches with gas burners and various glass work tools.

26. The following glass parts were produced:

a. Large stems; i. e., cathode stems with two sealed heater terminals which were used for all the high-power transmitter tubes with external anode. They were produced from lead glass tubes or glass envelopes of various shapes and sizes. Most of the large stems were produced manually; some of the operations being performed on the glass sealing lathes (paragraph 25b).

b. Medium-size stems; i.e. , cathode stems with sealed heater terminals and anode stems with one or two terminals. They were made by hand from glass envelopes. Lead glass was used for MT tubes (except MT 14), MR tubes, and DEM 2, DET 2 and DET 3; molybdenum glass was used for GT 15.

c. Small stems; i.e., heating stems for all low-power special tubes (DET 5, DET 11, CU 6, PT 6B, RHT 1, RHT 2, RD 200/3.5), as well as GU 14, GU 11, GT 14 and the GM tubes. There was also an anode stem in addition to the heater stem for the RD 200/3.5 and the PT 6B. The stems for RD 200/3.5, GU 14, GU 11, and GT 14 were molybdenum glass; they were lead glass for all the remaining tubes.

d. Complete terminals, i.e., metal terminals (paragraphs 13-16) plus the sealed glass.

(1) Heater terminals were nickel-iron, conical-shaped, with a knife edge (paragraph 13), or platinum terminals (paragraph 14) to which a lead glass tubing, narrowed into evacuation tubing, was sealed. These terminals were used for all high-power transmitter tubes with external anode. After the terminal was tested and found to be vacuum-proof, the evacuation tubing was cut off and the terminal was sealed to the heating stem (paragraph 26 a).

(2) Grid terminals were copper, conical-shaped with a knife edge which was sealed to lead glass tubing narrowed into evacuation tubing. This terminal was sealed to the envelope of the anode of CAT 14, CAT 201, ACT 201, CAT 9, ACT 16, and CAT 6K (paragraph 13 b).

(3) Grid platinum terminals (to be sealed directly into glass) /Annex C, Fig. 5/ were straight platinum terminals /Annex C, Fig. 1 a/ sealed into lead glass and to a lead glass tubing narrowed into evacuation tubing. This terminal was used for CAT 6, ACT 14, CAM 3, CAT 3, CAT 10, CAT 12A, CAT 20, as well as for those MT-type tubes in which the terminal was sealed to the glass envelope. The remaining MT-type tubes had the grid terminal sealed into the heater stem.

(4) Anode terminals /Annex C, Fig. 6) for GT 15, GU 14, GU 11, and GT 14 /Annex C, Fig. 7/.

e. Sealing of the glass envelope anode knife edge was performed on the glass work lathe as mentioned above; the anode was placed on one of the revolving spindles of the lathe and the envelope on the other. The anode and the envelope were centered and while revolving they were softened by gas burners. When the glass was sufficiently softened it was pulled onto the anode and sealed to it. Then the gas flames were gradually lowered. This procedure was followed with all high-power tubes with external anode. /Annex D, Figs 1 and 3./ When sealing glass envelopes to the knife edges of the nickel iron grid ring of the CAT 17 tube, first one envelope was sealed and then the other /Annex D, Fig. 2/. The procedure was similar to the one mentioned above.

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ASSEMBLY OF TUBES

Assembly Shops

27. Assembly of all tubes produced in the Plant was in the assembly shop on the second floor of the Main Production Building. The production and assembly of GM tubes was in a special shop on the second floor of the Main Production Building. 21. In addition to the usual equipment, so-called rotary stands were used in the assembly shop. Each stand consisted of a steel plate as a base and an axial radial ball bearing (an axial bearing and radial ball bearing conbined as one unit). A rectangular support device with a conical opening was set into the ball bearing,and into this conical opening was placed a support with a head. The head was of the same shape and size as the inside of the stem of the tube which was to be assembled. The stem was placed on the head of the support. The size of the base plate of the stand varied from 15 x 15 cm. to 30 x 30 cm. The height of the stand was about 20 cm. The stands were of three different sizes.

Assembly Process

28. In the assembly of high-power electronic tubes, the heater stem was set on the head of the support and the cathode was attached to the stem so that the metal terminals of the heater stem were screwed or clipped to the support of the cathode. Then, the sleeve of the grid was slipped on the cylindrical part of the stem and screwed on. The cathode was then tested for electrical conductivity. This testing was performed in a testing apparatus which consisted of a base on which the cathode with grid and stem was set. All of these tube parts were covered by a bell in order to maintain a neutral atmosphere, usually nitrogen. There was a supply of power with an adjustable auto-transformer, an ammeter, and voltmeter. The measuring instrument showed whether the conductivity was correct. (It was correct when the connecting parts of the system did not develop resistance, or when the rod of the cathode was not broken.)

29. In the assembly of medium-power special tubes (mercury rectifiers: GU 11, GU 14, GT 15, GT 14.), the heating stem of the cathode was set on the head of the support as explained above (paragraph 27). Then the cathode, a strip coated with $BaCO_3$(barium carbonate) or $Ba(OH)_2$ (barium hydroxide) was welded to the three terminals of the stem. The cathode shield was slipped on over the cathode and welded to the metal terminal. Then, with the thyratrons only, GT 14 and GT 15, the cathode shield was covered by a grid, which was welded to the grid terminal, which went through the heating stem. The grid was also welded to the support which went through the heating stem.

30. In the assembly of low-power special tubes, the bottom of the cathode was attached to the metal input leads which went through the heater stem of the tube, and the cathode was attached to the tension device. The tension device was attached to the upper ceramic insulating plate. This upper insulating plate was laid on the support which went through the heater stem. The upper ends of the grid supports were set into the upper insulating plate; the lower ends were set into the lower insulating plate which was attached to the same supports as the upper insulating plate. The sleeve of the anode was slipped over the cylindrical part of the stem and screwed on. There were two exceptions to the above procedure. With the RD 200/3.5 tube, the sleeve of the grid was attached to the cathode stem and the anode was attached, also by a sleeve, to the anode stem which was placed opposite the cathode. With the PT 6B tube, two of the three grids were attached as mentioned above but the third grid was attached by a sleeve to the cylindrical part of the heater stem. The anode was attached to the anode stem.

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31. Before assembly, those metal parts (mainly small nickel-iron-copper parts) which were supposed to come into the envelope were reduced. By reduction, the surface of the parts were purified. The reduction process was performed in two reduction furnaces /Annex E/ which were located in the Main Production Building on the first floor.[22] These furnaces were made in the plant during 1945 and 1946. The internal fireproof tubing was probably imported; the quartz tubing was imported [redacted] The parts to be reduced 25X1 were placed on a molybdenum plate, put into the opening of the cooler, and then pushed into the furnace where they were left at a fixed temperature for a prescribed period of time. The temperature was controlled by [redacted] means of an optical pyrometer [redacted] 25X1 [redacted] After reduction, the molybdenum plate containing the parts was pushed into the cooler and left until cooled.

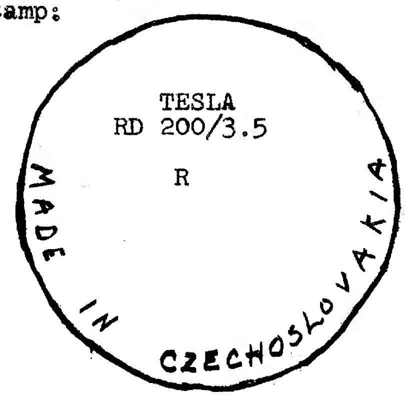
32. The sealing of the glass envelope to the glass stem for the tubes was as follows:

a. The sealing for high-power transmitter tubes with external anode was performed on glass-seal lathes; the large tubes were placed on the lathe in a vertical position and smaller tubes in a horizontal position. The smallest tubes in this category, for instance ACT 9 and ACM 1S, were sealed on the sealing machine. The copper anode, sealed to the envelope, was set into one of the two spindles of the lathe; the stem, with the cathode and the grid, was put into the opposite spindle. Then the stem, along with the cathode and grid, was slipped inside the anode. The lathe was set into operation and the revolving parts were centered while the lathe was fixed in a horizontal position. When the lathe was put into a vertical position, the revolving glass parts were heated by burners until the glass envelope was sealed to the glass stem and the seal was polished by a glass-work tool. After the temperature was lowered by turning off the burners, the lathe was returned to the horizontal position and the tube was taken out and sent to the section for pre-evacuation.

b. The sealing for medium-power transmitter tubes was performed on the sealing machines (paragraph 27, c). After the glass stem was sealed to the glass envelope, the tube was gradually cooled in the tempering equipment. When sealing the MT and MR tubes and DEM 2, DET 2, DET 3 tubes, the glass stem was sealed to the glass envelope before the anode stem was sealed to the envelope.

c. The sealing of low-power special electronic tubes was similar to the sealing of the medium-power transmitter tubes (paragraph 32 b).

33. The various supports and bases and auxiliary parts (paragraphs 21, 22) were attached to most of the tubes after the degassing and evacuating process and with the remaining tubes after the testing of the tubes.[23] After the tubes were finished they were polished and stamped. An example of the stamp:



"R" was the mark of the Tesla-Vrsóvice Plant; "H", the Hloubetin Plant; "V," the Vrchlabi Plant; the Roznov Plant carried the letter "R" also. This stamp was placed in the center of the glass envelope. The serial number of the tube was put below this stamp. With the high-power transmitter tubes, if the serial number, placed on one of the internal parts was visible, no serial number was placed on the envelope of the tube. In addition to the designation described above, the high-power transmitter tubes bore the designation indicating the established heater voltage (in volts and in tenths of one volt). This designation was placed below the trade stamp and below the serial number, if any.

Materials Used in Production [24].

34. In addition to the standard materials for production of tubes, the following materials were used:

a. Tubes, sheets, rods, wires and cables, all made of copper.

b. Aluminum sheets.

c. Brass sheets and brass rods.

d. Tin soldering rods.

e. Alabaster gypsum for sealing supports and bases.

f. Bakelite putty for supports, bases, and coverings.

35. In addition to these materials, the following semifinished parts and finished parts from domestic suppliers were used by the plant:

a. Ceramic insulating plates for low-power special tubes, insulating plates for heating supports for high-power transmitter tubes of the smallest sizes, ceramic bases for small low-power special tubes (DET 11, PT 6B, and RD 200/3.5, and ceramic supports for the grid outlet for the RD 200/3.5).

b. Bakelite bases for DET 5 (European designation "A Socle"), Bakelite bases for RHT 1 and RHT 2 (K8A), and bases for CU 6 and for the GMT tubes. [25].

c. Bronze castings for rings for the large copper anodes.

d. Anode coverings, copper or brass, for small special tubes and grid coverings for RD 200/3.5 tubes.

e. Bellowed bronze tubes for forced air-cooled heating leads and bronze tubing for water-cooled heating leads.

f. Various screws and similar items.

36. There were frequently shortages or complete lack of the following materials in the plant:

a. Molybdenum and tungsten materials of certain kinds and dimensions.

b. NiFe sheeting, the lack of which was particularly felt during 1951 and 1952.

c. OFHC copper.

d. SiO insulators, [redacted] used to attach large cathodes to grids. 25X1

25X1

e. Lead glass and molybdenum glass parts, the lack of which was caused by the large percentage which had to be returned because of poor quality.

The lack of these materials caused production difficulties which were partly overcome by temporarily shifting production from one type of tube to another.

25X1

<u>Annexes</u>

A. Sketches of Cathodes and Grids

B. Sketches of Medium Copper Anodes, Anode Shield Rings and Various Terminals

C. Sketches of Various Terminals

D. Sketches of Seals

E. Sketch of Reduction Furnace

Annex A Sketches of Cathodes and Grids

Fig. 1.

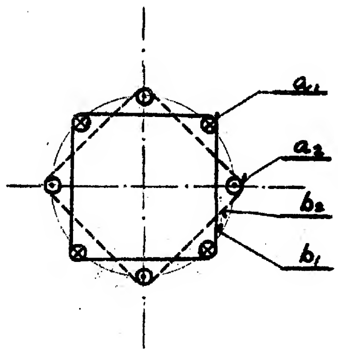


Fig. 2.

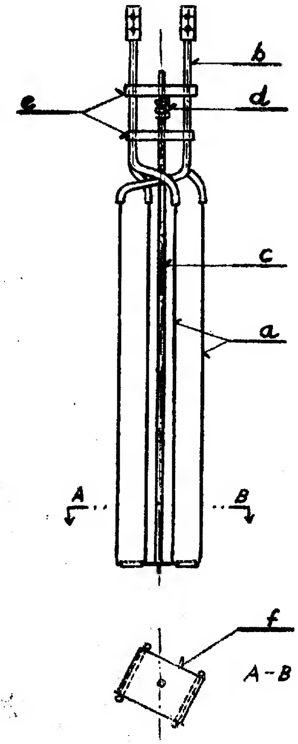


Fig. 3.

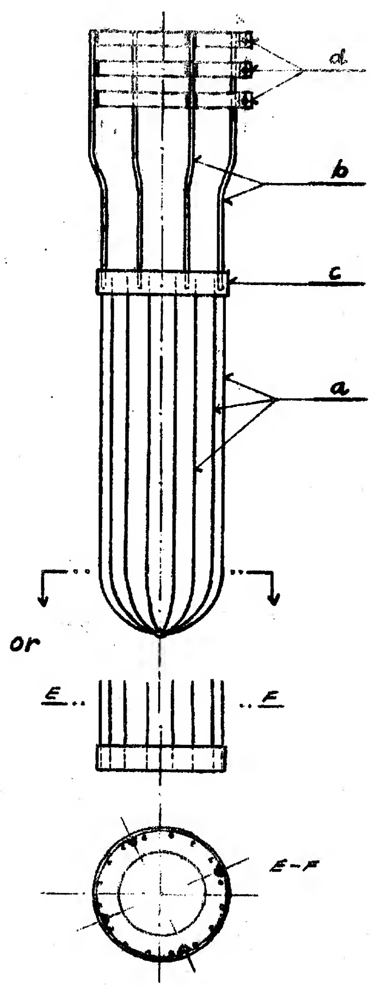
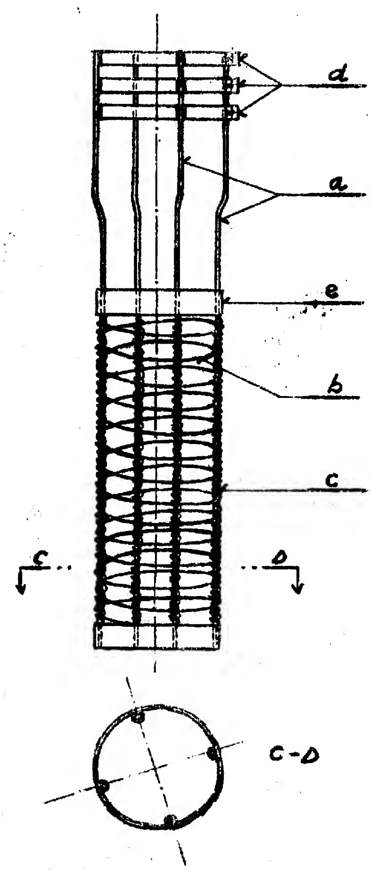


Fig. 3a.



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LEGEND TO ANNEX A

1. Cathode: for high-power transmitter tubes

    a1. Cathode rod through which current passed from top to bottom.

    a2. Cathode rod through which current passed from bottom to top.

    b1-b2. So-called distance equipotential squares.

2. Cathode: with tension device

    a. One branch of the cathode

    b. Molybdenum support

    c. Tension device

    d. Spring of the tension device

    e. Ceramic insulating plate

    f. Bridge connecting both branches of the cathode

3. Grid: consisting of rods

    a. Grid rods (a total of 16 rods)

    b. Grid supports

    c. Connecting and simultaneously shielding part

    d. Sleeves of the grid

3a. Grid: consisting of supports, wound with wire

    a. Supports (a total of four supports)

    b. Winding of the grid

    c. Spiral-shaped wire to attach the winding to the supports

    d. Sleeves of the grid

    e. Connecting and simultaneously shielding part

Annex B Sketches of Medium Copper Anodes, Anode Shield Rings and Various Terminals

Fig. 1.

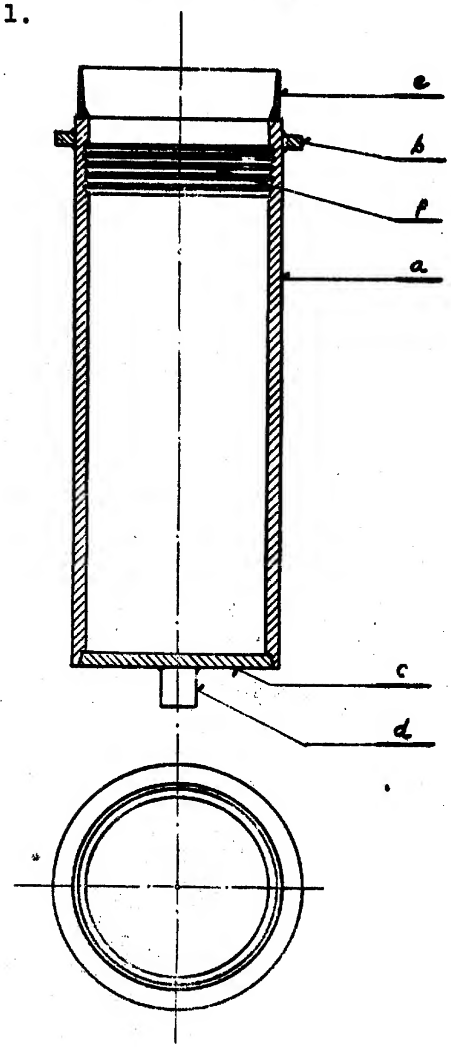


Fig. 2.

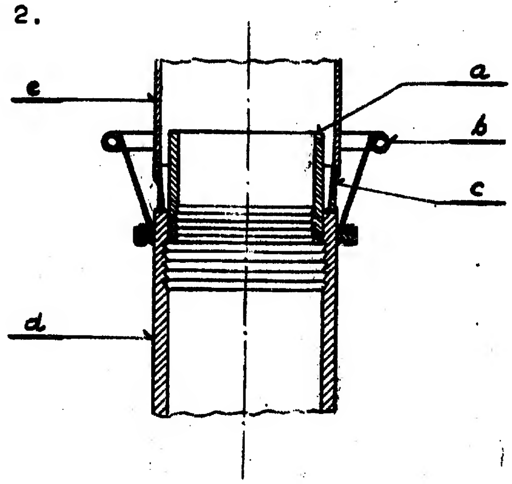


Fig. 3.

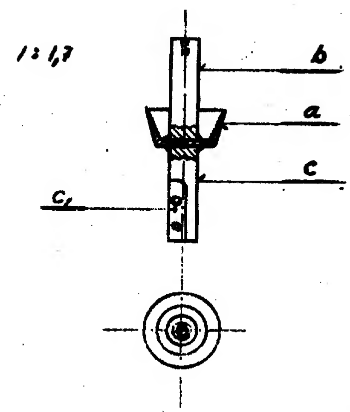


Fig. 4.

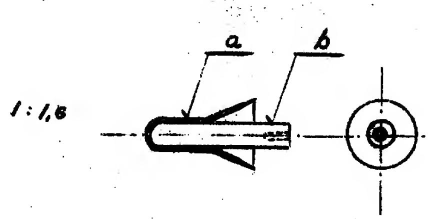


Fig. 5.

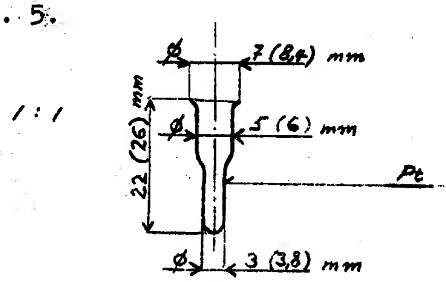
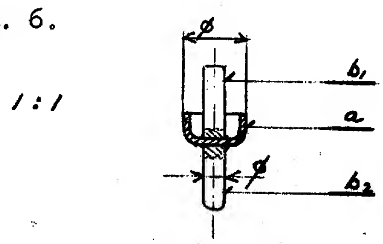


Fig. 6.



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LEGEND TO ANNEX B

1. Medium Copper Anodes
   a. Anode tube
   b. Band
   c. Bottom
   d. Pin
   e. Nickel-iron ring with knife edge
   f. Internal notches

2. Anode Shield Rings
   a. Internal shield ring
   b. External shield ring (here, in this case, simultaneously a cooling device)
   c. Nickel-iron ring with knife edge sealed to the glass envelope
   d. Copper anode
   e. Glass envelope

3. Heater Terminal: with a knife edge
   a. Conical part with a knife edge
   b.-c. Pins
   c. Threaded openings

4. Grid Terminal: with a knife edge
   a. Conical part with a knife edge
   b. Pin

5. Platinum Terminal (so-called "zder")

5. Chromium-iron Terminal
   a. Chromium-iron; bowl-shaped part to be sealed to the lead glass
   b1-b2. Copper pins

25X1

Annex C Sketches of Various Terminals

Fig. 1.

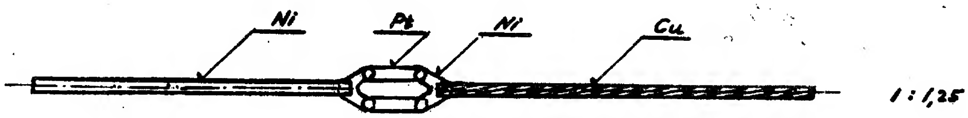


Fig. 1a.

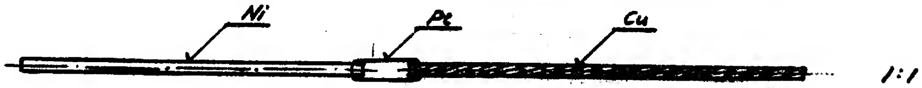


Fig. 2.

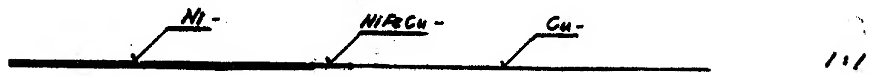


Fig. 3.

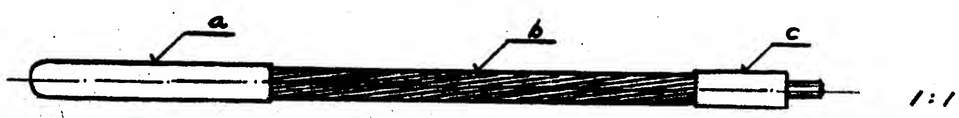


Fig. 4.

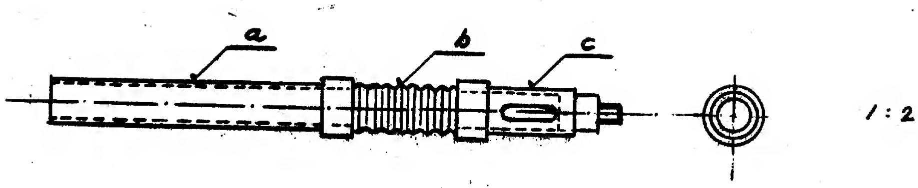


Fig. 5.

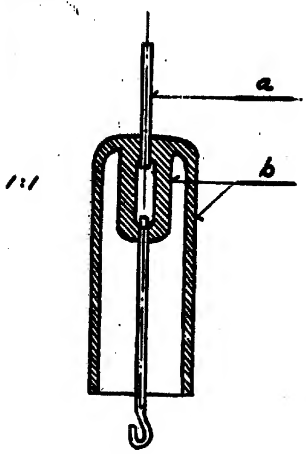


Fig. 6.

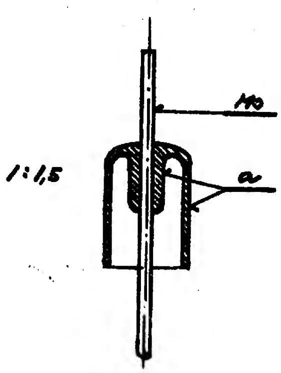
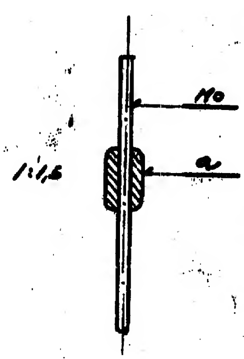


Fig 7.



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LEGEND TO ANNEX C

1.-1a. Straight Platinum Terminals

2. Nickel-iron-copper Wire Input Leads

3. Non-cooled Heater Leads

   a. External copper part

   b. Copper cable

   c. Internal copper part

4. Forced Air-cooled Heater Leads

   a. Copper tubes

   b. Accordion-shaped bronze tube

   c. Internal copper tube, with openings

5. Complete Grid Terminal

   a. Straight platinum terminal

   b. Lead glass

6. Complete Anode Terminal: for GT-15

   Mo. Molybdenum rod

   a. Molybdenum glass

7. Complete Anode Terminal: for GU-14, GU-11, GT-14

   Mo. Molybdenum rod

   a. Molybdenum glass

Annex D Sketches of Seals

Fig. 1.

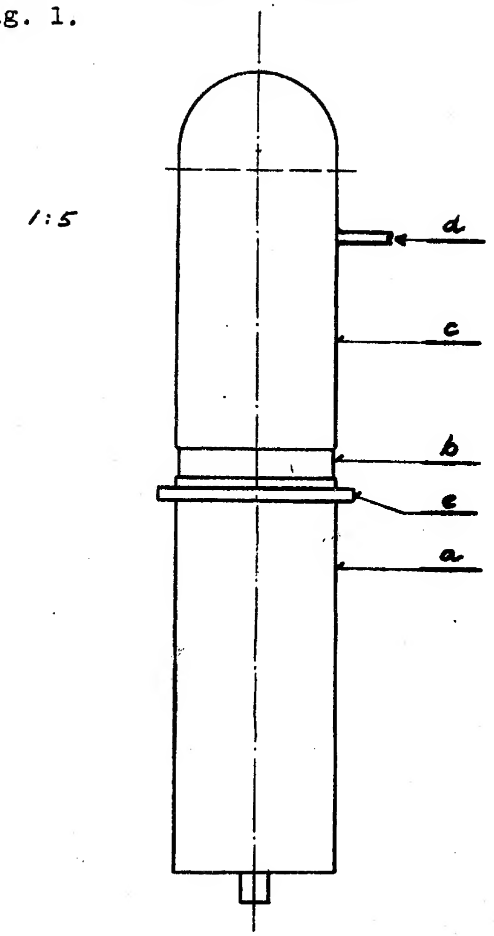


Fig. 2.

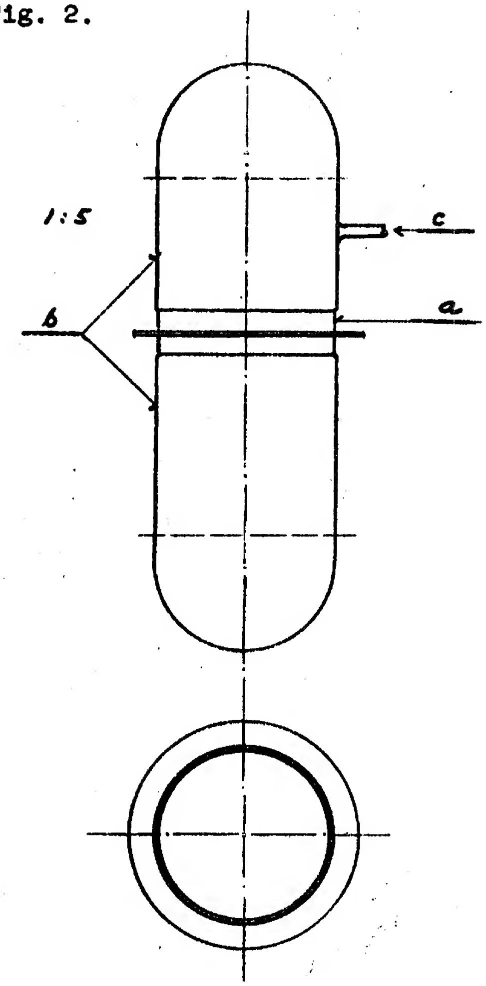
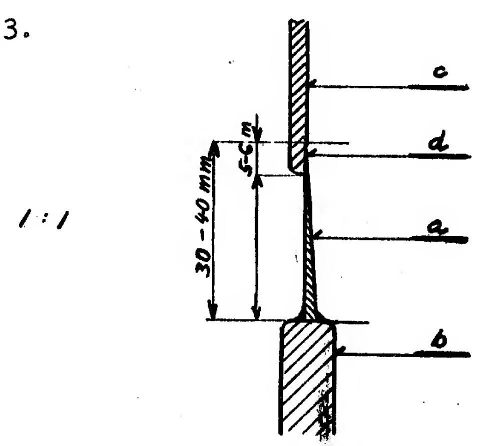


Fig. 3.



LEGEND TO ANNEX D

1. Seal of the Envelope to the Anode Knife Edge

    a. Copper anode

    b. Nickel-iron ring with knife edge

    c. Lead glass envelope sealed to the ring

    d. Evacuating tube

    e. Anode band

2. Seal of the Envelopes to the Two Knife Edges of the Grid Ring of the CAT 17C Tube

    a. Grid ring

    b. Lead glass envelopes

3. Detailed Diagram of the Seal of the Envelope to the Knife Edge

    a. Nickel-iron ring with a knife edge

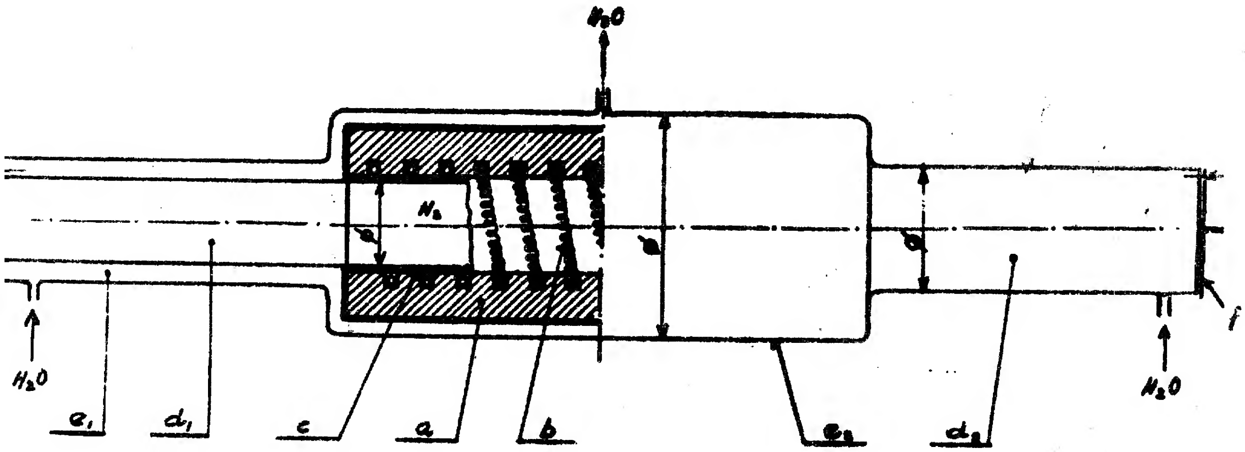
    b. Upper part of the copper anode

    c. Lead glass envelope

    d. Seal

25X1

Annex E
Sketch of Reduction Furnace



LEGEND TO ANNEX E

Reduction Furnace

a. Tube of fireproof material

b. Resistance spiral, electrically heated

c. SiO glass tube

d1-d2. Coolers

e1-e2. Iron sheet cover placed around the furnace and coolers

f. Furnace opening